

NON-PUBLIC?: N
ACCESSION #: 9409270190
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Quad Cities Unit One PAGE: 1 OF 6

DOCKET NUMBER: 05000254

TITLE: HPCI Flow Oscillation During Operability Run Due To
Broken Instrumentation Wire
EVENT DATE: 08/20/94 LER #: 94-008-00 REPORT DATE: 09/19/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 3 POWER LEVEL: 004

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(i)

LICENSEE CONTACT FOR THIS LER:
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Ext. 3115

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: BJ COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At approximately 1200 on 08/20/94, Unit-1 was in the start up mode at approximately 4% power. The Operations Department had satisfactorily completed the uncoupled overspeed test for the High Pressure Coolant Injection (HPCI) Periodic Pump Operability Run (QCOS 2300-1).

During the HPCI low pressure operability run, oscillations in flow and speed were detected in the Control Room (CR) at 1908 hours. The HPCI test was terminated, and trouble shooting activities were started.

At 0538 hours, on 08/21/94, the Unit-1 reactor was manually scrammed by procedure to achieve a shutdown condition required by Technical Specifications.

Trouble shooting activities identified a broken feedback wire on the HPCI

flow convertor instrument loop Linear Variable Displacement Transducer (LVDT). Causal Factors attributed for the broken wire are Work Practices, and Maintenance/Testing.

The HPCI front standard instrument wiring, and general material condition, was inspected for Unit-1 and Unit-2 with special attention given to wire crimping integrity. All wires to the effected unit HPCI LVDT had the wire terminal lugs replaced with new parts, and double crimping placed on all of them. The Unit-1 HPCI FIC instrument loop was functionally checked, calibrated, and verified operational.

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END OF ABSTRACT

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PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power.

EVENT IDENTIFICATION: HPCI flow oscillation during low pressure operability run due to broken instrumentation wire.

A. CONDITIONS PRIOR TO EVENT:

Unit: One Event Date: August 20, 1994
Event Time: 1837
Reactor Mode: 3 Mode Name: Startup/Hot Standby
Power Level: 004

This report was initiated by Licensee Event Report 254\94-008.

STARTUP (3) - In this position, the reactor protection scram trips, initiated by condenser low vacuum and main steamline isolation valve closure are bypassed, the low pressure main steamline isolation valve closure trip is bypassed and the reactor protection system is energized, with IRM and APRM neutron monitoring system trips and control rod withdrawal interlocks in service.

B. DESCRIPTION OF EVENTS:

At approximately 1200 on 08/20/94, Unit-1 was in the start up mode at 4% power. The Operations Department had satisfactorily completed

the uncoupled overspeed test for the High Pressure Coolant Injection (HPCI) B1 Periodic Pump Operability Run (QCOS 2300-1). At approximately 1837 hours, the HPCI turbine was recoupled with the pump, and the low pressure part of the operability test was prepared.

During the HPCI low pressure operability run, oscillations in flow and speed were detected in the Control Room (CR) at 1908 hours.

The unit Nuclear Station Operator (NSO) took the HPCI flow controller from the automatic mode to the manual mode of operation. The system speed and flow oscillations were reduced to minimal oscillations.

The HPCI test was terminated, a Nuclear Work Request (NWR) and Problem Identification Form (PIF) were generated. Trouble shooting activities were started involving the Instrument Maintenance Department (IMD), Operations Department Shift Foreman (SF) and the System Engineer.

At 2330 hours, the IMD reported to the SE that there was an abnormality associated with the programmable HPCI flow indicating controller (FIC) software. The FIC software was downloaded, and several lines of the program were missing when compared to historical software printouts.

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At 0255 hours on 8/21/94, the HPCI FIC was reprogrammed per historical printouts known to be correct, and a briefing was held in the CR to continue the HPCI operability run.

At approximately 0450, the System Engineer reported to the SE that voltage indication at the HPCI FIC signal converter was not indicating properly. The voltage indication was -1.26 volts (normal reading is approximately +4 volts).

Due to the HPCI system not being able to be declared operable in the time required by Technical Specifications, the SE held a briefing with appropriate personnel on the procedural requirements to scram and cool down Unit-1.

At 0538 hours, the Unit-1 reactor was manually scrammed per procedure, all control rods were inserted, and reactor cooldown was

initiated.

Operations made a 1 hour ENS phone call to the NRC at 0610 hours per 10CFR50.72(b)(1)(i)(A).

Subsequent trouble shooting activities by the System Engineer and IMD personnel identified a broken feed back wire on the HPCI flow convertor instrument loop. The broken wire was located on the Motor Gear Units (MGU) Linear Variable Displacement Transducer (LVDT).

Investigation found that an Operations Department Shift Foreman (SF) noted the FIC signal convertor had been indicating properly at +4 volts after the HPCI overspeed test, and prior to the low pressure operability run. It was concluded that the wire broke after the HPCI overspeed test, and prior to the low pressure operability run.

The following is a summary of conclusions and Causal Factors (C/F) relating to problems which may have contributed to equipment malfunctions.

C. CAUSE OF THE EVENT:

This event is being reported in accordance with 10CFR50.73(a)(2)(i)(A): The licensee shall report completion of any shutdown required by Technical Specifications.

C/F: Work Practices
Maintenance/Testing

The primary cause of the HPCI speed and flow oscillations was due to work practices associated with crimping terminal lugs to the feed back wire located on the system MGU LVDT. The feed back wire located on the LVDT had a single crimp located on the terminal lug holding the wire strands.

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It is suspected the wire strands had been previously weakened by movement during maintenance activities in the HPCI front standard. The LVDT wire bundle was not supported by any type of bracket or cable tie, and is located directly in front of the access panel to the HPCI front standard.

The broken wire prevented feedback to the FIC instrument loop signal

converter. The signal converter could not equalize properly, and an oscillation developed. The oscillation eventually caused the MGU to hunt for position between the low speed stop (LSS) and the high speed stop (HSS), which caused HPCI speed and flow oscillations observed in the CR.

The 1-2340-1 FIC instrument loop was last tested operational under NWR Q09807 on 7/28/94.

During this investigation, it was determined that the 1-2340-1 FIC software abnormality was associated with a programmable default mode setting, and would not have affected primary operation of the HPCI system.

The 1-2340-1 FIC software abnormality did not contribute to the HPCI speed and flow oscillations observed on 8/20/94, and will be documented under PIF #94-2117, initiated by the RA Department.

D. SAFETY ANALYSIS:

At no time during this event were the station personnel or the public at risk, per Technical Specification 4.5.C. The plant is allowed 12 hours in which to successfully complete each test once reactor pressure is adequate to perform each test. Because the low pressure test could not be successfully completed within the window, an orderly shutdown was initiated in compliance with Technical Specification 3.5.C.4.

Core Spray BM! subsystems and Low Pressure Coolant Injection BO! mode of Residual Heat Removal system were operable throughout this event to provide adequate core cooling in the event of a design base accident at reactor pressure less than 325 psig.

If this event had occurred in combination with a design basis accident, the automatic safety function of operation for the HPCI system would not have been achieved. However, by placing the FIC into "manual" mode of operation, the setpoint for desired Technical Specification of pressure and flow could have been achieved.

E. CORRECTIVE ACTIONS:

The immediate corrective actions associated with the HPCI system oscillation was to trouble shoot the system FIC circuitry and instrumentation loop. Results of the trouble shooting activity found a broken wire on the FIC LVDT, and a FIC software problem.

With Unit-1 at low power operation, during startup activates, a manual scram was initiated by procedure to achieve shutdown conditions required by Technical Specifications.

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The SE quarantined the HPCI turbine front standard, the HPCI control relays, and the HPCI controller and signal convertor panels.

PIF #94-2082 was initiated, and a level 3 investigation started utilizing the IMD, System Engineering, Regulatory Assurance and Operations personnel.

The investigation team developed an action plan to look at all areas of concern, and inspected the components quarantined. After inspection and trouble shooting, the appropriate areas quarantined were released.

The HPCI front standard instrument wiring, and general material condition, was inspected for Unit-1 and Unit-2 with special attention given to wire crimping integrity. Unit-2 was inspected and found to be acceptable.

All wires to the Unit-1 HPCI MGU LVDT had the wire terminal lugs replaced with new parts, and double crimping placed on all of them. The double crimping provides for one crimp holding the conductor wires, and the other crimp holds the conductors insulation.

A work history review was performed using the Total Job Management (TJM) and Nuclear Tracking System (NTS) data bases. There is no record of work being performed on the Unit-1 HPCI system LVDT.

The single crimp was probably installed during maintenance activities prior to 1985 when TJM was first initiated. The station presently uses the double crimping practice adopted from the Electrical installation Standard (EIS section N-C, Tab 0018), initiated 05/29/87. Since then standard practice for the Electrical Maintenance Department (EMD) and IMD is to double crimp every safety related terminal lug with a qualified crimping tool during new installation, or during as-found inadequacies.

The LVDT is safety related, and all crimping performed on the safety related equipment has to be witnessed by a QC inspector at Quad Cities Station.

The Unit-1 HPCI LVDT wire bundle was securely mounted to prevent movement, and the wire cover to the component had rubber glued to the backside to prevent unintentional shorting to the component terminal strip during maintenance activities.

The 2-2340-1 FIC software was checked and verified to be correct per IMD. The 1-2340-1 FIC software was reprogrammed per the manufacturer technical manual, tested for appropriate response, and verified correct by the IMD.

The Unit-1 HPCI FIC instrument loop was functionally checked, calibrated, and verified operational.

Investigation revealed the HPCI FIC software problem would not have caused system oscillations, and attributed the event to the instrument loop LVDT broken wire.

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F. PREVIOUS OCCURRENCE:

A Nuclear Plant Reliability Data System (NPRDS) search was performed for failures at Quad Cities Station involving the HPCI turbine, and piece parts of the component. The HPCI MGU and LVDT are considered piece parts of the turbine to the NPRDS program. There is not any failures in the NPRDS database with respect to the HPCI MGU LVDT or the FIC 1(2)-2340-1.

A nation wide search of the NPRDS database could find no failures similar to this event.

A three year historical search of the Nuclear Tracking System database (NTS) did not identify any LER's involving HPCI flow control instrumentation, or any system inoperabilities associated with poor wire crimping techniques.

G. COMPONENT FAILURE DATA:

There was no component failure associated with this event.

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GGC-94-117

September 14, 1994

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: Quad Cities Nuclear Power Station
Docket Number 50-254, DPR-29, Unit One

Enclosed is Licensee Event Report (LER) 94-008, Revision 00, for Quad Cities Nuclear Power Plant Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(i)(A). The licensee shall report completion of any shutdown required by Technical Specifications.

There are no additional commitments being made by this letter.

If there are any questions or comments concerning this letter, please refer them to Nick Chrissotimos, Regulatory Assurance Administrator at 309-654-2241, ext. 3100.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

G. G. Campbell
Station Manager

GGC/TB/plm
Enclosure

cc: J. Schrage
C. Miller
INPO Records Center

NRC Region III

STMGR\11794.GGC

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